OPERATOR CERTIFICATION ADVANCED MATH SHEET

DO NOT WRITE ON MATH SHEET

♦*Equivalents*♦

1 cubic foot = 7.48 gallons
1 cubic yard = 27 cubic feet
1 gallon of water = 8.34 pounds
1 p.s.i. = 2.31 feet of water
1 foot of head = 0.43 p.s.i.
1 horsepower = 0.746 kilowatts
1 acre = 43,560 square feet
1 mile = 5,280 feet

1 day = 1440 minutes
1 mg/L = 1 ppm
1 MGD = 694 gpm
π (Pi) = 3.14
Radius of circle = diameter ÷ 2
Circumference of circle = π x diameter
Temp. °Centigrade = (°Fahrenheit - 32°) x 0.55
Temp. °Fahrenheit = (°Centigrade x 1.8) + 32°F

♦*Area and Volume Formulas*♦

Circles/Cylinders:
Area, sq. ft. = π x radius, ft. x radius, ft.
Volume, cu. ft. = π x radius, ft. x radius, ft. x height, ft.

Rectangles:
Area, sq. ft. = length, ft. x width, ft.
Volume, cu. ft. = length, ft. x width, ft. x height, ft.

Cone:
Volume, cu. ft. = 0.33 x π x radius, ft. x radius, ft. x height, ft.

♦*General Formulas*♦

Detention Time, hr. = $\frac{\text{volume, gal. x 24 hr./day}}{\text{flow, gpd}}$

Velocity, ft./sec. = $\frac{\text{flow, cu. ft./sec.}}{\text{area, sq. ft.}}$

Velocity, ft./sec. = $\frac{\text{distance, ft.}}{\text{time, sec.}}$

Velocity, ft./sec. (Pipe) = $\frac{\text{gpm}}{\text{diameter, in. x diameter, in. x 2.448}}$

Water HP = $\frac{\text{gpm x head, ft.}}{3960}$

Brake HP = $\frac{\text{water horsepower}}{\text{pump efficiency \%}}$

Motor HP = $\frac{\text{water horsepower}}{\text{(pump efficiency \% x motor efficiency \%)}}$

Motor HP = $\frac{\text{pump horsepower}}{\text{motor efficiency \%}}$

Dose, mg/L = $\frac{\text{chemical feed, lbs./day}}{\text{flow, MGD x 8.34 lbs./gal.}}$

Weir Overflow Rate, gpd/ft. = $\frac{\text{flow rate, gpd}}{\text{weir length, ft.}}$

Surface Loading Rate, gpd/sq.ft. = $\frac{\text{flow rate, gpd}}{\text{area, sq. ft.}}$

Solids Loading, lbs./day/sq.ft. = $\frac{\text{solids applied, lbs./day}}{\text{surface area, sq. ft.}}$

% Stroke Setting = $\frac{\text{required feed, gpd}}{\text{maximum feed, gpd}} \times 100$

% Removal = $\frac{\text{(in – out)}}{\text{in}} \times 100$

Screening Removed, cu. ft./mg = $\frac{\text{screenings, cu. ft.}}{\text{flow, MGD}}$

Day's Supply = $\frac{\text{total chemical in inventory, lbs.}}{\text{average use, lbs./day}}$

Flow, cu. ft./sec. = area, sq. ft. x velocity, ft./sec

Dose, mg/L = $\frac{\text{chemical feed, lbs.}}{\text{volume, MG x 8.34 lbs./gal.}}$

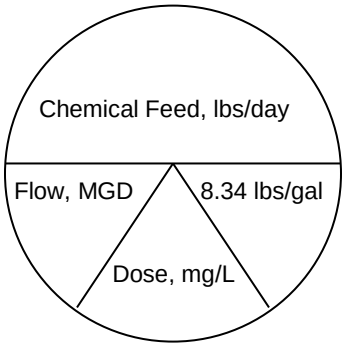
$ Cost Per Day = hp x 0.746 x $ rate x hours/day

Chemical Feed, lbs./day = flow, MGD x dose, mg/L x 8.34 lbs./gal.

Chemical Feed, lbs. = volume, MG x dose, mg/L x 8.34 lbs./gal.

Solids Applied, lbs./day = flow, MGD x conc., mg/L x 8.34 lbs./gal.

Slope = $\frac{\text{fall, ft.}}{\text{length, ft.}}$



♦*Chlorine Formulas*♦

Chlorine Dose, mg/L = chlorine demand, mg/L + chlorine residual, mg/L

Chlorine Residual, mg/L = chlorine dose, mg/L – chlorine demand, mg/L

Chlorine Demand, mg/L = chlorine dose, mg/L – chlorine residual, mg/L

Pounds/Day of HTH = $\frac{\text{lbs./day chlorine needed}}{\text{\% chlorine of HTH}}$

♦*Water Math*♦

Filtration Rate, gpm/sq.ft. = flow rate, gpm / filter surface area, sq. ft.

Filter Backwash Rate, gpm/sq.ft. = backwash flow rate, gpm / filter surface area, sq. ft.

Filter Backwash Water % = backwash water, gal. x 100 / water filtered, gal.

Wash Water, gpm = area, sq. ft. x rise, ft. x 7.48 gal./cu. ft. / minutes

Reservoir Volume, ac./ft. = reservoir volume, cu. ft. / 43,560 sq. ft./ac.

Reservoir Volume, gal. = volume, ac-ft. x 43,560 sq. ft./ac. x 7.48 gal./cu. ft.

Surface Area, ac. = surface area, sq. ft. / 43,560 sq. ft./ac.

Chemical Feed, lbs. = surface area, ac. x dose, lbs./ac.

Mean or Average = sum of values or measurements / number of values or measurements

Median = middle value of a group of data

♦*Wastewater Math*♦

Grit Removed, cu. ft./MG = volume of grit, cu. ft. / volume of flow, MG

Pond, Detention Time, days = pond volume, ac-ft / flow rate, ac-ft/day

Pond Area, acres = avg. width, ft. x avg. length, ft. / 43,560 sq. ft./acre

Pond, Population Loading, (number of persons/acre) = population served, persons / pond area, acres

Pond, Organic Loading (lbs. BOD/day/acre) = flow, MGD x BOD concentration, mg/L x 8.34 lbs./gal. / Pond area, acres

Pond, Hydraulic Loading (inches per day) = depth of pond, inches / detention time, days

Trickling Filter, Organic Loading (lbs. BOD/day per 1,000 cu. ft.) = BOD applied, lbs./day / volume of media, 1,000 cu. ft.

Sludge Age (in days) = MLSS in aeration tank (lbs). / TSS entering aeration tank (lbs/day)

Sludge Volume Index (SVI), ml/g = 30 min. settleability test, ml/L x 1,000 mg/g / MLSS, mg/L